ANNUAL REPORT

1962

TOWN OF TILLSONBURG

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ON

TILLSONBURG SEWAGE TREATMENT PLANT

OWRC PROJECT - 58-S-12

TILLSONBURG SEWAGE TREATMENT PLANT

OPERATED FOR

THE TOWN OF TILLSONBURG

BY

THE ONTARIO WATER RESOURCES COMMISSION

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PREPARED BY
THE DIVISION OF PLANT OPERATIONS

TILLSONBURG

BASIS OF DESIGN

The Tillsonburg Sewage Treatment Plant is an activated sludge type plant with a design capacity of 665,000 gallons per day.

The plant was designed to serve a population of 7,000 persons with a per capita flow of 95 gallons per day with a BOD of the raw sewage of 235 ppm and a S.S. of 250 ppm. The maximum hydraulic design rate of flow is 1.33 million gallons per day.

PLANT DESCRIPTION

Influent Works

The plant flow enters an influent chamber from a 12 inch force main from the John Pound Street Pumping Station and a 15 inch gravity sewer. The influent chamber is equipped with an adjustable bypass weir.

From the influent chamber the flow passes through an 18" Chicago Pump barminutor which continuously screens and cuts the coarse material in the sewage without removing it from the flow.

A bypass screen is also provided in case the barminutor breaks down.

Grit Removal

The plant is equipped with a Chicago Pump Aer-degritter with dimensions of 13' x 6' x 8' = 624 cubic feet or 3,900 Imperial gallons. At the design flow of 665,000 gallons, the detention period is 8.4 minutes. The cross velocities at the bottom of the

tank are about 2.0 feet per second. This effectively separates the grit by keeping the higher organics in suspension.

This unit is capable of efficient grit removal for flows up to a maximum of 4.0 MGD.

Primary Settling

From the grit chamber the flow passes into two rectangular primary clarifiers where the heavier solids are allowed to settle to the bottom. Each clarifier is 50' - 4" x 10' - 0" x 8' - 0" for a combined volume of 8,050 cubic feet or 50,300 Imperial gallons. At the design flow rate of 665,000 gallons per day, the detention period in the primary clarifiers is 1.82 hours. The surface settling rate is 795 US gallons/sq. ft. of tank/day and the weir overflow rate is 16,000 US gallons/linear foot of weir/day.

The clarifiers are equipped with sludge removal and skimming mechanisms. The settled material, called sludge, and the skimmed material deposited in the scum hoppers are drawn off and pumped to the digester.

Aeration Section

There are two rectangular aeration tanks, each 50' x 30' x 15' for a total volume of 45,000 cubic feet or 281,000 Imperial gallons. At design flow, the detention period is 10.1 hours. Air is introduced into the aeration tanks through Sparjer diffusers at a rate of 1.6 cubic feet/US gallon. The air is supplied by two Roots-Connersville Air Blowers, each with a 40 HP Tamper A.C. Motor and each capable of delivering a measured air supply of 1100 cfm.

Final (Secondary) Settling

The final clarifiers are two rectangular units each 50'-4" x 10'-0" x 12'-3" for a total volume of 12,320 cubic feet or 77,000 Imperial gallons. The detention period at design flow is 2.77 hours. The surface settling rate is 795 US gallons/sq. ft. of tank/day and the weir overflow rate is 5,470 US gallons/linear foot of weir/day. The activated sludge settles out and is then pumped to a sludge division box where it is normally returned to the aeration tanks.

Chlorination

The chlorine contact chamber is a rectangular tank with corrugated baffles. The dimensions of the tank are 20'-0" x 11'-3" x 9'-9" with a volume of 2,240 cubic feet or 13,950 Imperial gallons. At design flow, the contact period is 30.2 minutes. The chlorinator was manufactured by Wallace and Tiernan with a maximum capacity of 400 lbs/day.

Flow Meter

The flow is measured by a Foxboro flow meter. This meter records, indicates and integrates the flow passing through a 9" Parshall flume. In addition, it provides automatic control of the chlorinator by a vacuum transmitter.

Digester

The digester is a one unit circular type with a volume of 32,000 cubic feet. The heated digester capacity is 4.57 cubic feet per capita and the design loading is 1.48 pounds of solids per cubic feet of tank per month. The digester contents are re-circulated on a time-cycle basis and heated to a temperature of 95^{o}

Fahrenheit by means of a heat exchanger fired by sewage gas and fuel oil. The sludge heat exchanger has a rated capacity of 375,000 BTU/hour.

The digested sludge is removed by tank truck and can be used as fertilizer and soil conditioner.

TABLE I

FLOWS

MONTH	PEAK RATE	MAXIMUM DAY	MINIMUM DAY	AVERAGE DAY
JAN.				.350
FEB.				.350
MAR.				.350
APR.	0.860	.535	.250	.410
MAY	0.875	.490	.190	.425
JUNE	0.760	.475	.230	.410
JULY	1.225	.550	.200	.380
AUG.	1.145	.550	.240	.440
SEPT.	1.275	.560	.320	.435
OCT.	1.285	.530	.360	.445
NOV.	0.975	.530	.415	.450
DEC.	0.870	.678	.255	.450
AVG.	1.030	.544	.273	.408

Some difficulties have been encountered in getting the flow indicator to read properly. Consequently, the flow records for the first three months are estimates only.

It appears that the flow meter is now giving an accurate indication of the flows at the plant.

It is to be noted that the peak rates in each month are twice the design capacity of 665,000 GPD.

During times of extreme peak flow, some of the raw sewage overflows at the influent manhole and bypasses the plant.

TABLE II

GRIT REMOVAL

	GRIT REMOVED	
MONTH	CU. FT.	CU. FT./MG
JAN.	7	0.7
FEB.	6	0.6
MAR.	10	1.1
APR.	9	0.7
MAY	11	0.8
JUNE	11	0.9
JULY	11	0.9
AUG.	22	1.6
SEPT.	36	2.8
OCT.	20	1.5
NOV.	20	1.5
DEC.	14	1.0
TOTAL	177	14.1
AVG.	14.8	1.2

It is to be noted that most of the grit is removed during August and September which also coincides with periods of high flow.

This situation suggests that the grit which is settling out in some of the sewers during periods of normal flow is washed down to the plant during periods of extremely high flow.

SAMPLING RESULTS

Graph No. 1 indicates that the average BOD of the raw sewage is 250 ppm which is reduced by primary treatment to an average of 150 ppm and further reduced to an average of 16 ppm in the aeration section for a total reduction of 90%.

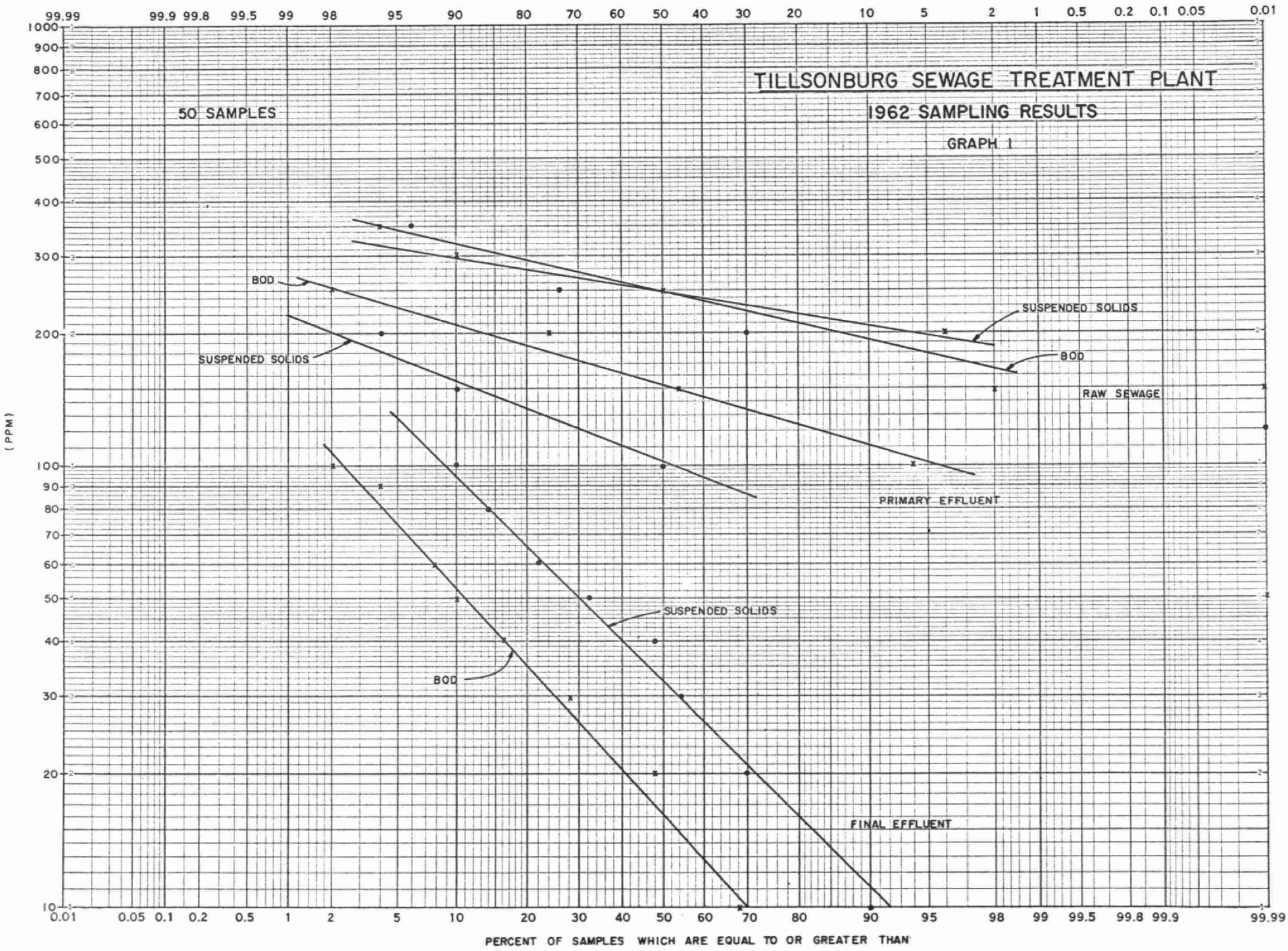
The suspended solids in the raw sewage averaged 250 ppm and underwent a reduction by primary treatment to 100 ppm and a further reduction to 32 ppm in the aeration section for a total reduction of 87%.

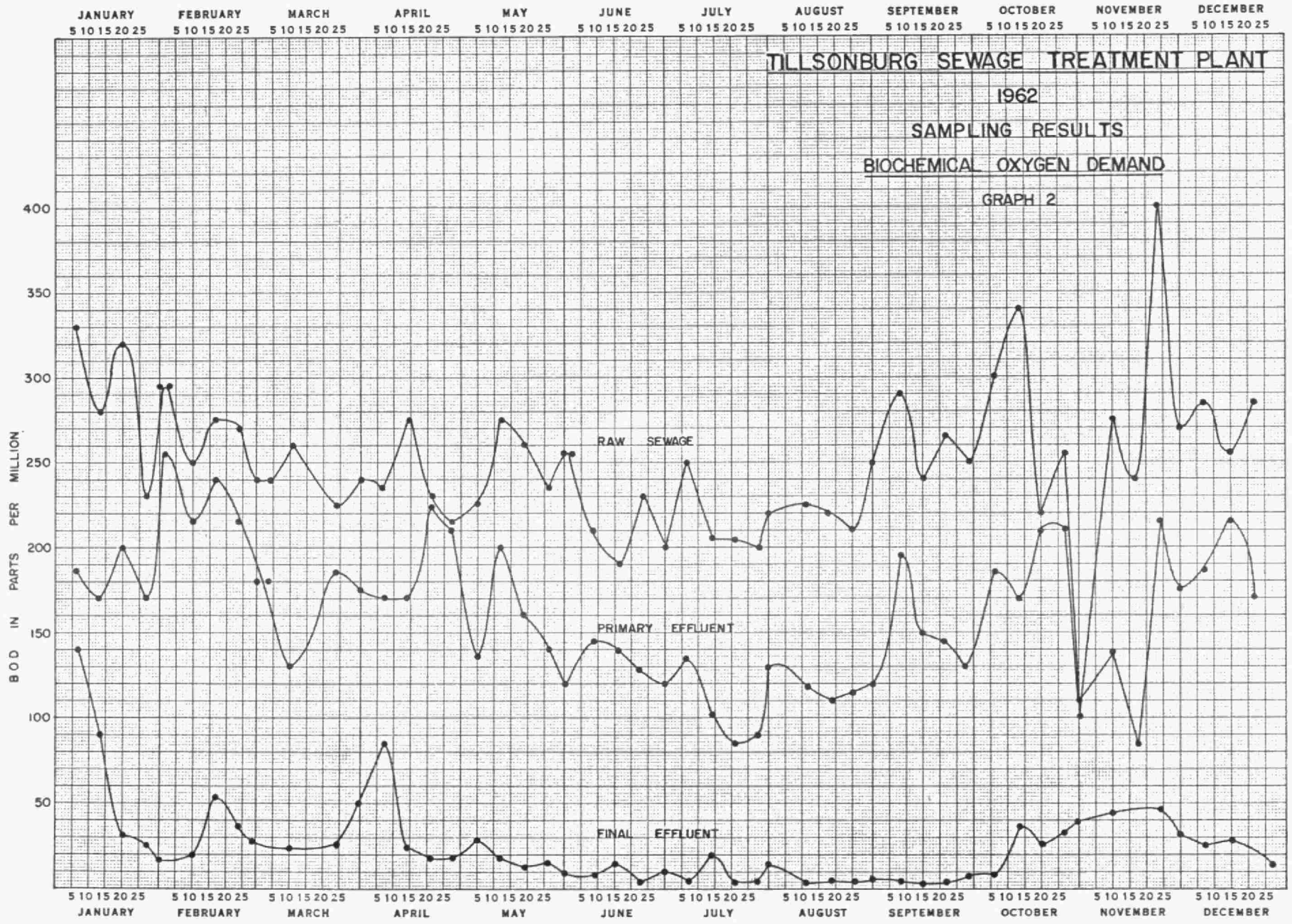
RAW SEWAGE

The raw sewage is of average strength and is quite consistent in BOD and S.S. It can be seen that 90% of the time the raw sewage BOD is greater than 190 ppm and 10% of the time is greater than 320 ppm. The suspended solids follow a similar pattern in that 90% of the raw sewage S.S. are greater than 210 ppm and 10% of the time is greater than 295 ppm.

PRIMARY EFFLUENT

As seen in Graph No. 1, the average BOD of the raw sewage is reduced from 250 ppm to 150 ppm. This is an average reduction of 40%.


TILLSONBURG SEWAGE TREATMENT PLANT
1962 SAMPLING RESULTS
GRAPH 1
50 SAMPLES
BOD
SUSPENDED SOLIDS
SUSPENDED SOLIDS
BOD
RAW SEWAGE
PRIMARY EFFLUENT
SUSPENDED SOLIDS
BOD
FINAL EFFLUENT
(PPM)
PERCENT OF SAMPLES WHICH ARE EQUAL TO OR GREATER THAN
99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
1000 900 800 700 600 500 400 300 200 100 90 80 70 60 50 40 30 20 10
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9 99.99


TILLSONBURG SEWAGE TREATMENT PLANT
1962
SAMPLING RESULTS
BIOCHEMICAL OXYGEN DEMAND
GRAPH 2
BOD IN PARTS PER MILLION
400
350
300
250
200
150
100
50
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25

The average S.S. of the raw sewage is reduced from 250 ppm to 100 ppm. This is a reduction of 60%.

The reduction of BOD and S.S. is quite satisfactory.

FINAL EFFLUENT

The final effluent at the Tillsonburg Sewage Treatment Plant is extremely variable as can be seen in Graph No. 1.

Although the average BOD in the final effluent is satisfactory at 16 ppm; 20% of the time the BOD exceeds 35 ppm and 10% of the time it exceeds 52 ppm.

It is seen that 90% of the time the S.S. exceed 11 ppm and 10% of the time the S.S. exceed 96 ppm. The cause of the poor suspended solids reduction has been under investigation during the year but as yet no clear-cut answer has been found.

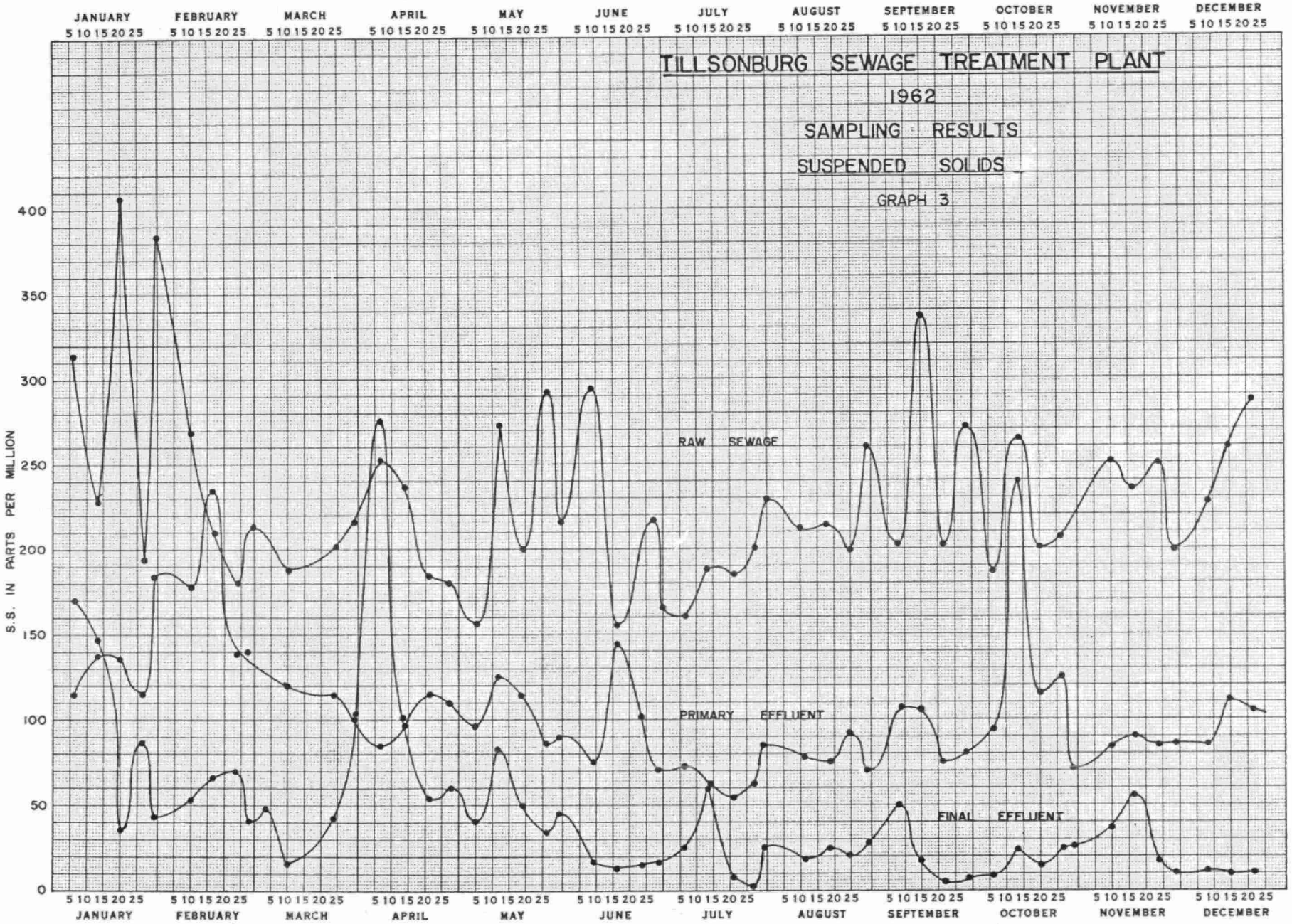
The rapidly fluctuating hydraulic loading has certainly been one of the major factors causing difficulty in maintaining good process efficiency. High flows reaching the plant cause the suspended solids to wash over the final weirs.

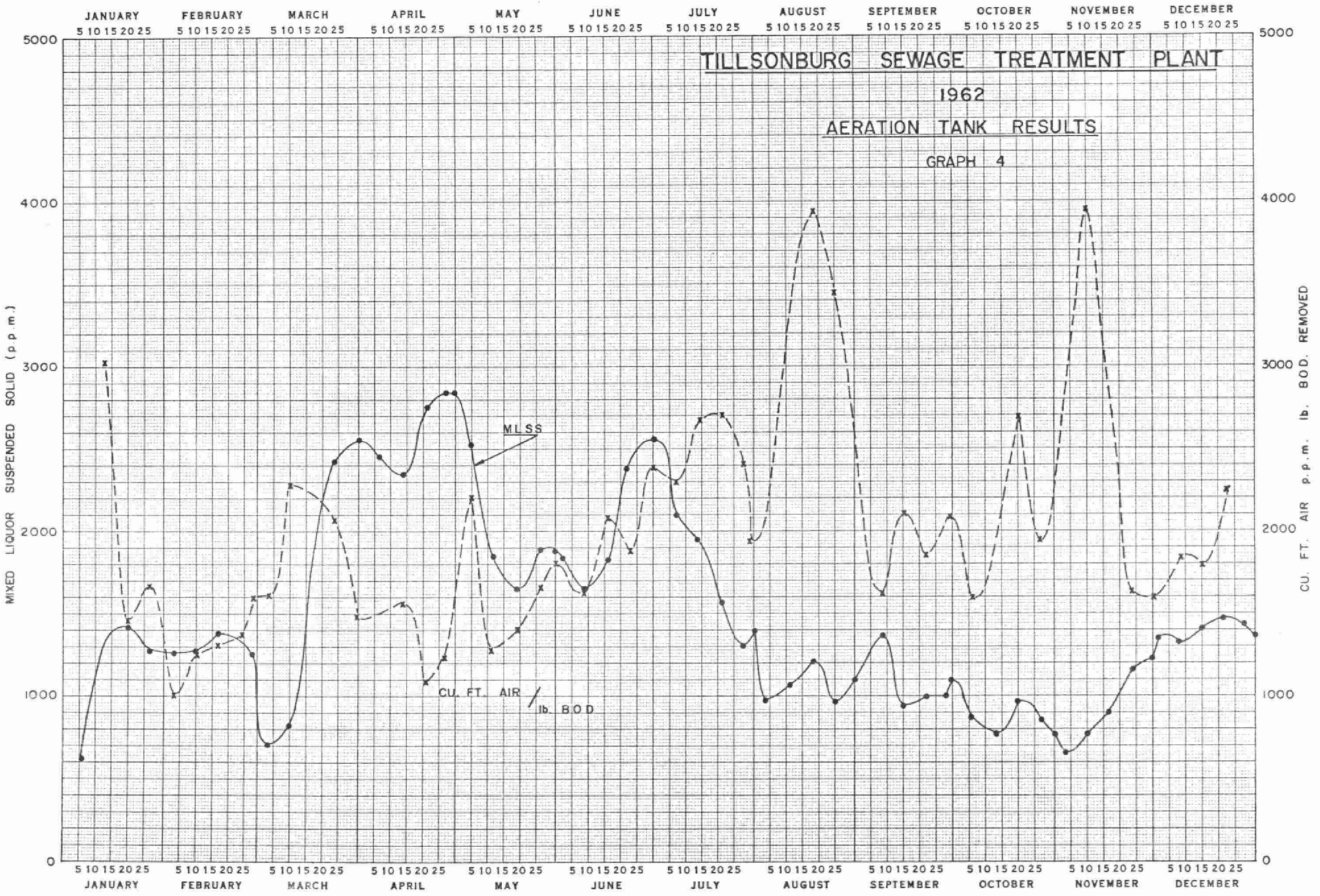
AERATION TANK

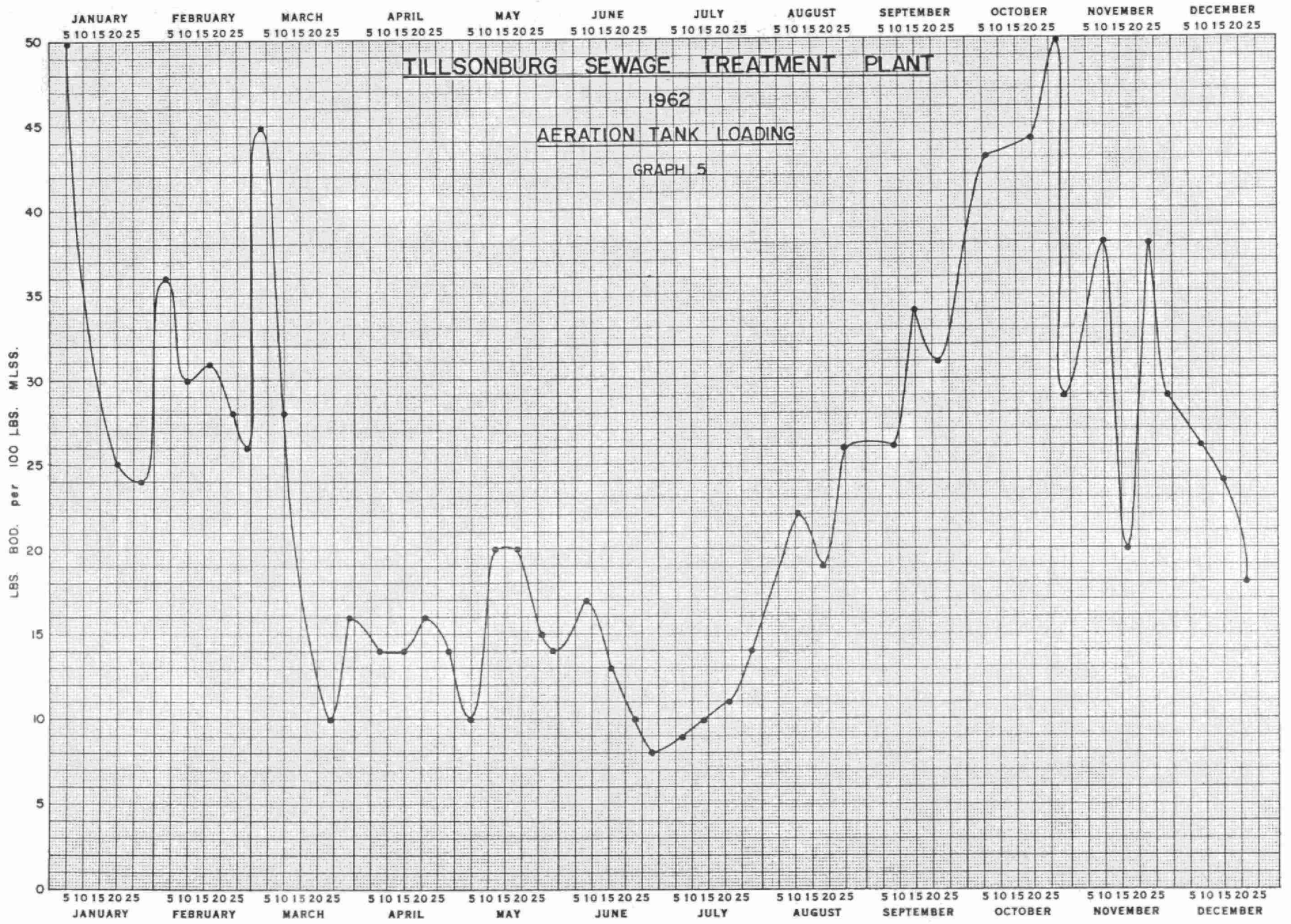
Many graphs have been plotted in an attempt to better understand the operation of the plant.

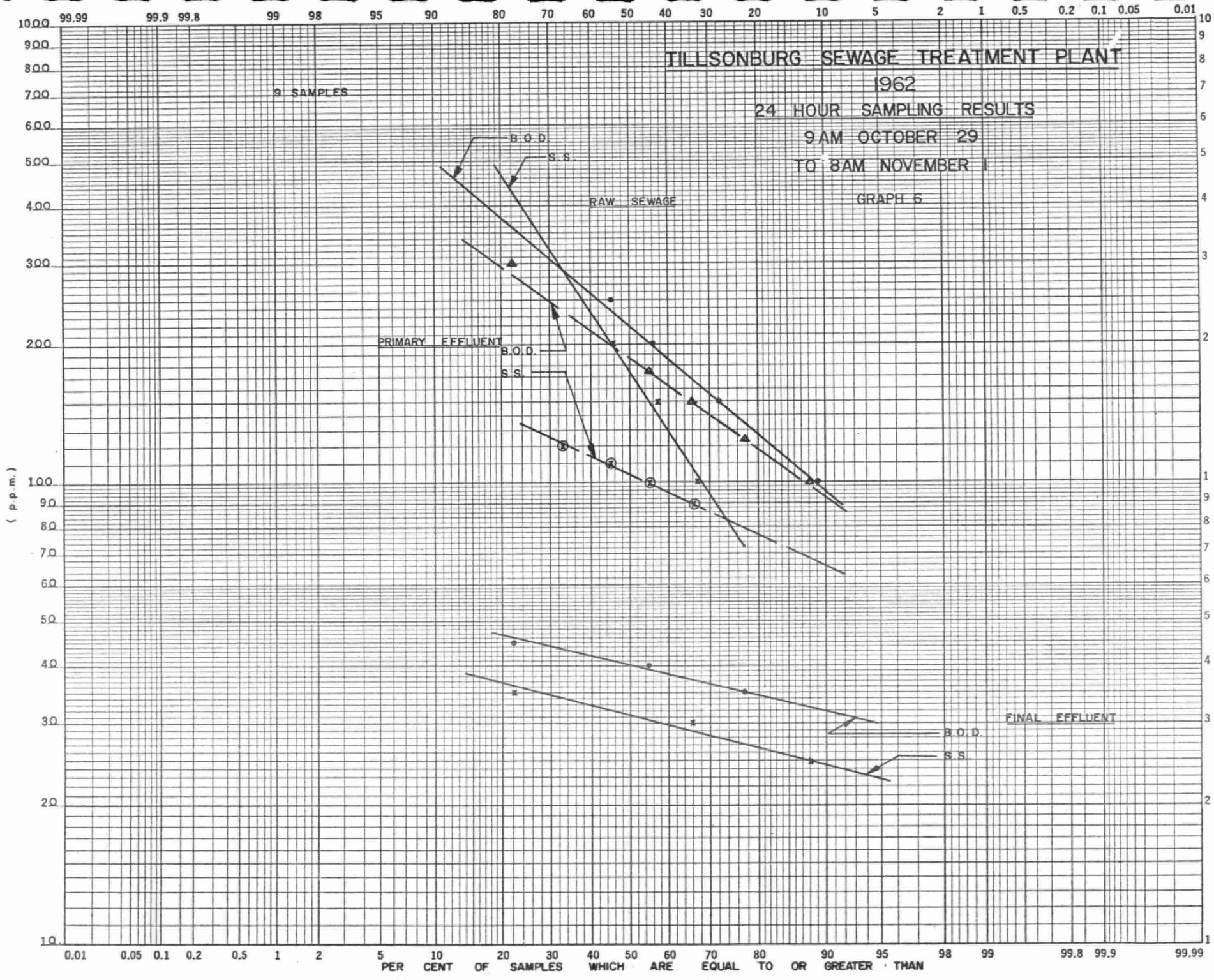
Biochemical Oxygen Demand (BOD)

The main purpose of the aeration tank is to satisfy the oxygen demand of the primary effluent and to coagulate the fine suspended solids in the primary effluent so they will settle in the final tank.


TILLSONBURG SEWAGE TREATMENT PLANT
1962
SAMPLING RESULTS
SUSPENDED SOLIDS
GRAPH 3
S.S. IN PARTS PER MILLION
0
50
100
150
200
250
300
350
400
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25


TILLSONBURG SEWAGE TREATMENT PLANT
1962
AERATION TANK RESULTS
GRAPH 4
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25
5000
4000
3000
2000
1000
0
MIXED LIQUOR SUSPENDED SOLID (p.p.m.)
CU. FT. AIR p.p.m. lb. BOD. REMOVED
MLSS
CU. FT. AIR / lb. BOD


TILLSONBURG SEWAGE TREATMENT PLANT
1962
AERATION TANK LOADING
GRAPH 5
LBS. BOD. per 100 LBS. MLSS.
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25
0
5
10
15
20
25
30
35
40
45
50


TILLSONBURG SEWAGE TREATMENT PLANT
1962
24 HOUR SAMPLING RESULTS
9 AM OCTOBER 29
TO 8 AM NOVEMBER 1
GRAPH 6
9 SAMPLES
RAW SEWAGE
B.O.D.
S.S.
PRIMARY EFFLUENT
B.O.D.
S.S.
FINAL EFFLUENT
B.O.D.
S.S.
(p.p.m.)
PER CENT OF SAMPLES WHICH ARE EQUAL TO OR GREATER THAN
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

It can be seen from Graphs No. 2 and No. 3 that the final effluent is greatly improved during the summer months when the primary effluent is at its lowest strength.

Mixed Liquor Suspended Solids (M.L.S.S.)

The amount of mixed liquor suspended solids in the aeration section is determined by the amount of BOD entering the aeration section. A theoretical loading of from 20 to 35 pounds per BOD per 100 pounds of M.L.S.S. has been found to be the optimum for a plant of this size.

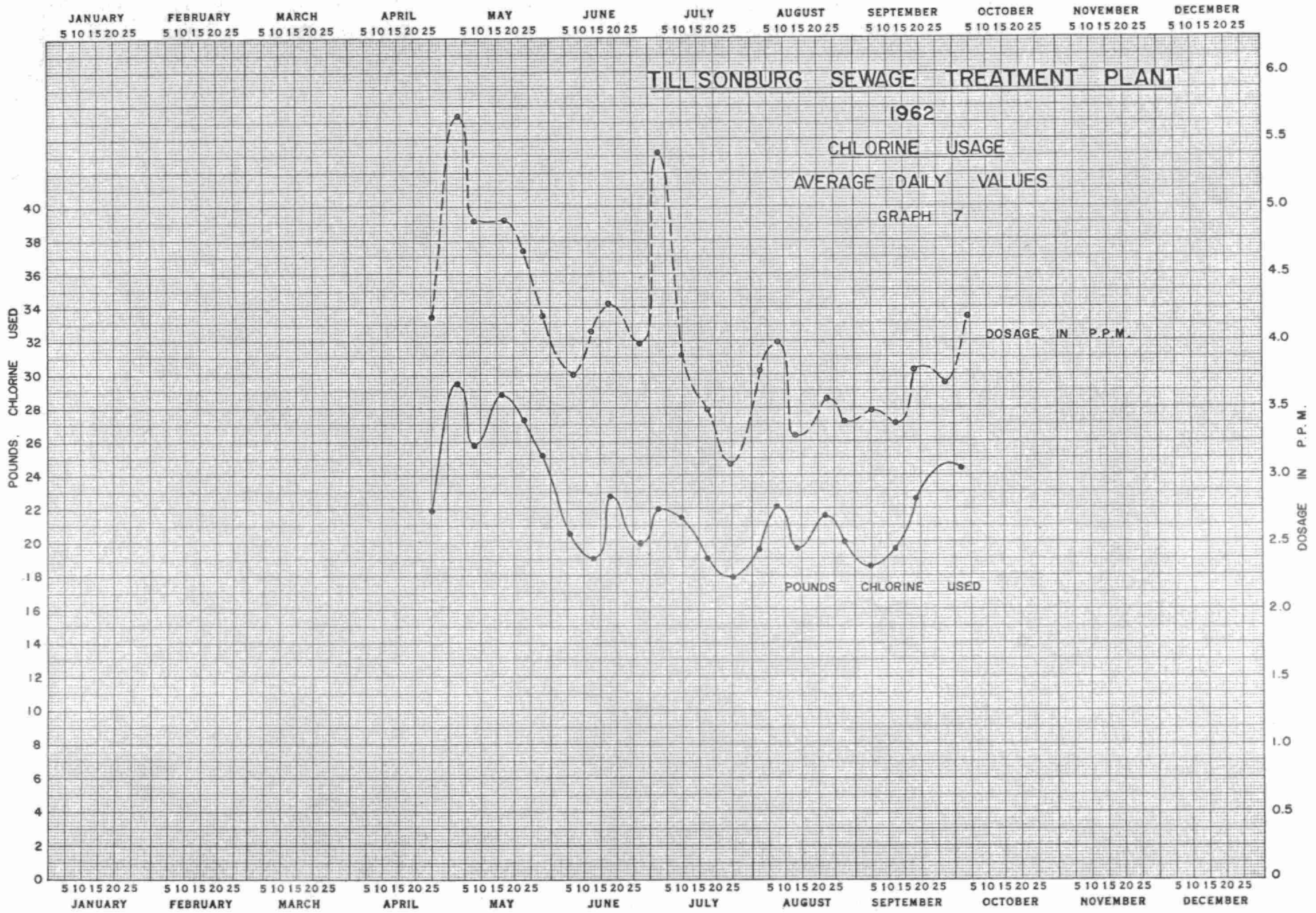
As can be seen from Graphs No. 4 and No. 5, the M.L.S.S. has been varied greatly in an attempt to determine the proper range of solids for the Tillsonburg plant. From these graphs it appears that a loading of 20 pounds BOD per 100 pounds of M.L.S.S. gives the best results and in 1963 the M.L.S.S. will be adjusted to keep the loading in this range.

24-HOUR SAMPLING PROGRAM

From 9:00 AM October 29 until 8:00 AM November 1, a continuous round-the-clock sampling program was undertaken in an attempt to discover the variation in the strength of the sewage and to correlate the results with the 8 hour samples normally taken.

The results of this sampling program are as follows:

	RAW SEWAGE		PRIMARY EFFLUENT		FINAL EFFLUENT	
	BOD	SS	BOD	SS	BOD	SS
Midnight to 8AM	103	74	101	77	40	32
8AM to 4PM	298	269	193	116	35	26
4Pm to Midnight	255	180	212	118	38	32
AVERAGE	219	175	169	104	41	31


TILLSONBURG SEWAGE TREATMENT PLANT
1962
CHLORINE USAGE
AVERAGE DAILY VALUES
GRAPH 7
DOSAGE IN P.P.M.
POUNDS CHLORINE USED
POUNDS CHLORINE USED
DOSAGE IN P.P.M.
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0

The sampling program, although quite short, revealed a typical variation over a 24 hour period. The strength from midnight to 8AM to about one-third the strength from 8AM to 4PM and the strength decreases only slightly from 4PM to midnight.

During this 24 hour sampling program, engineers from the OWRC Laboratory were making extensive tests on the aeration section. No unusual conditions were found as a result of the investigation but the operation of the aeration tank will be carefully controlled and observed during 1963.

PLANT CHLORINATION

The plant effluent is chlorinated at Tillsonburg from the beginning of May until the end of September. Chlorination is necessary to improve the effluent quality during the summer months when the stream flow is low and is possibly used by humans and animals.

Graph No. 7 indicates the pounds of chlorine added and the dosages to maintain a 15 minute residual of 0.5 ppm in the effluent.

SOLIDS REMOVAL

During 1962, 62,794 pounds of BOD and 50,844 pounds of suspended solids were removed from the raw sewage.

A total of 1,407,000 gallons of raw sludge were pumped to the digester for subsequent anaerobic decomposition and eventual removal by tank truck.

MONTH	GALLONS OF SLUDGE TO THE DIGESTER
JAN.	81,700
FEB.	101,200
MAR.	151,350
APR.	77,850
MAY	105,200
JUNE	102,800
JULY	111,100
AUG.	95,750
SEPT.	142,500
OCT.	138,000
NOV.	132,450
DEC.	167,100
TOTAL	1,407,000

SLUDGE HAULAGE

Sludge haulage was not required until the summer of 1962 due to repairs to the digester made during the previous winter in which the digester was emptied.

OPERATING COSTS

Table III outlines the operating costs of the Tillsonburg Sewage Treatment Plant under the various headings on a monthly basis. The total cost of $18,397.68 was $7,254.32 under the estimated 1962 budget and will be credited to the 1963 operating budget.

During 1962, casual help was hired to allow the operators to take off overtime built up during the initial operation of the plant.

The operation of the plant has now settled down and the operators have gained sufficient operating experience so that in the future casual help will not be required.

One of the problems contributing to overtime has been the rapid wearing out of components on the barminutors. These barminutors run continuously and chop up large particles in the sewage so that they will settle in the primary tanks.

The problem was discussed with the manufacturer who suggested that the barminutors be modernized to include a stop-n-go control which allows the barminutor to run only when sufficient trash has accumulated on the screen. This stop-n-go control is now standard on all new barminutors being sold. This new feature will decrease the amount of wear on the barminutor cutters.

INSPECTIONS

In 1962, the water pollution control plant at Tillsonburg was visited regularly for the purpose of inspection by Project Engineers

from the Division of Plant Operations of the OWRC. In addition, the Electronics Section made four trouble calls and the Maintenance Section three trouble calls and one inspection trip which is taken annually to check thoroughly every piece of equipment in the plant. Maintenance work carried out in 1962 included the servicing of the No. 2 sewage lift pump; the changing of air piping to the aeration section; and the checking of both barminutors while in operation.

SUMMARY

During 1962, the Tillsonburg Sewage Treatment Plant operated reasonably well with the exception of some periods when the final effluent results were unsatisfactory. It is felt that one of the contributing causes of this poor effluent are the excessive storm flows which wash solids through the plant. Other contributing factors have been investigated and a general improvement is expected in 1963.

TABLE 111

1962 PROJECT OPERATION STATEMENT

MONTH	EXPENDI-TURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIP-MENT	REPAIR & MAINTEN.	SLUDGE HAULAGE	WATER	SUNDRY
JAN.	1,104.08	576.92		120.04	280.34	(210.00)	70.17	213.97			39.51	13.13
FEB.	945.10	576.92		184.58	292.85	(211.10)	75.18		.75		8.82	17.10
MAR.	1,142.57	576.92		134.85	273.29	43.40	78.81		20.00		7.70	7.60
APR.	1,209.61	576.92		130.96	288.03		38.24				7.74	167.72
MAY	1,672.60	576.92		131.81	278.76	343.82	63.85		11.70		48.71	217.03
JUNE	1,557.73	576.92		133.40	256.26	349.05	101.81				79.31	60.98
JULY	1,314.93	576.92		140.75	262.64	26.85	76.44		17.28		88.22	125.83
AUG.	2,586.01	885.05	297.20	16.51	250.07	678.74	130.45		5.98	292.37	8.46	21.18
SEPT.	2,187.36	635.87	193.89	126.17	366.28	(140.00)	388.95		68.33	466.35	21.09	60.43
OCT.	1,346.31	626.08	124.69		389.71	10.50	77.49	86.44	3.50		13.97	13.93
NOV.	1,550.22	599.98		259.59	393.27	(298.84)	135.65	178.70		179.14	13.10	89.23
DEC.	1,781.16	1,111.97		120.64	386.69	(70.00)	79.02				10.73	96.36
TOTAL	18,397.68	7,897.39	615.78	1,499.70	3,718.19	522.42	1,316.06	479.11	173.29	937.86	347.36	890.52